Epidural Versus ON-Q Local Anesthetic-Infiltrating Catheter for Post-Thoracotomy Pain Control

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Objective: **The authors compared thoracic epidural with ON-Q infiltrating catheters in patients having open thoracotomy to determine whether one method better relieves postoperative pain and would allow earlier discharge from the hospital and, hence, cost savings.**

Design: **Retrospective chart review.**

Setting: **University hospital.**

Participants: **Fifty adult patients (24 to 81 years old) undergoing open thoracotomy by one surgeon.**

Interventions: **One group had thoracic epidural catheters placed by an anesthesiologist and then managed by the acute pain service. The other group had intraoperative ON-Q (ON-Q; I-Flow; Lake Forest, California) infiltrating catheters placed by the surgeon, wound infiltration with a local anesthetic, plus patient-controlled analgesia with an intravenous opioid.**

Measurements and Main Results: **The authors measured and compared average daily pain rating, maximum pain rating, time to discharge from the hospital, and total bill for hospital stay. Patients who received epidural analgesia had lower average pain scores on day 2 than did patients in the ON-Q group. Patients in the ON-Q group reported higher maximum pain scores on days 1 and 2 and at the time of discharge. Patients in the ON-Q group were discharged an average of 1 day earlier; hence, their average total bill was lower.**

Conclusions: **Even though the maximum pain score was higher in the ON-Q group, patients were comfortable enough to be discharged earlier, resulting in cost savings. ON-Q infiltrating catheters present a good option for providing postoperative analgesia to patients having an open thoracotomy.**

KEY WORDS: postoperative pain, open thoracotomy, epidural analgesia, On-Q soaker system, length of hospital stay, cost saving

PAIN AFTER THORACOTOMY is considered one of the most severe forms of pain after surgery.[1] Suboptimal pain control leads to postoperative pulmonary complications by impairing pulmonary mechanics. Hence, good control of postoperative pain after thoracotomy is associated with decreased incidence of complications such as mucous plugging, hypoxia, atelectasis, and pulmonary infections.[2,3] Postoperative pain management also is important because inadequate control can lead to the development of chronic pain[4] in these patients and is a major factor in compliance with postoperative spirometry and in overall patient satisfaction.

Current analgesic options for post-thoracotomy pain include thoracic epidural analgesia, a thoracic paravertebral block, and intravenous patient-controlled analgesia (PCA). Local anesthetic infusion in the wound, paravertebral or intercostal nerve infusions can be done using a catheter and an ON-Q elastomeric pump.

At this institution, most patients having an open thoracotomy used to get an epidural, which was switched to oral analgesics once the chest tubes were removed. This transition to oral analgesics sometimes delayed the patient's discharge by 1 day, and because of a shortage of beds available, some surgeons looked for other analgesic options.

The authors performed a retrospective study to determine whether the ON-Q infiltrating catheter provides similar analgesic results when compared with thoracic epidural analgesia and whether patients with an ON-Q catheter are discharged earlier from the hospital and, hence, incur cost savings.

METHODS

After approval from the Institutional Review Board, the authors reviewed the records of 50 patients who underwent thoracotomy by a single surgeon at this hospital between January 1, 2008, and June 30, 2011. There were no commercial sponsors involved in the study. Patients included in this study were ages 18 to 81. The patients were categorized according to the method of postoperative pain control they had received: either thoracic epidural analgesia (TEA) or a local anesthetic-infiltrating ON-Q catheter (I-Flow; Lake Forest, CA) with intravenous patient-controlled analgesia (IV PCA) for postoperative pain control. The authors excluded patients whose surgery was emergent. A muscle-sparing thoracotomy incision was used for all patients; no patient had rib resection done. Patients received a general anesthetic, including desflurane, IV sufentanyl infusion, and paralytic agent as needed. Both groups had access to rescue analgesia via acetaminophen, tramadol, ketorolac or ibuprofen, and pregabalin, if needed, during the postoperative period.

Epidural Group

After informed consent was obtained, thoracic epidural catheters were placed by the anesthesiologist. All epidural catheters were placed in the thoracic T4-T8 region and were managed postoperatively by the 24-hour acute pain service. Epidural infusions typically were started intraoperatively once the patient's hemodynamics were stable and

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maintained until removal of the patient's chest tube. Epidural sites, dressing, neurologic function, and motor function were assessed during each shift by the acute pain service. Epidural solutions included a combination of local anesthetic (bupivicaine 0.075% or 0.1%, with hydromorphone [10 μg/mL, 5 μg/mL, or 2 μg/mL] or fentanyl [5 μg/mL]). All epidurals had a basal infusion and an as needed patient-controlled bolus (PCEA). If patients experienced persistent nausea, drowsiness, or pruritus despite rescue medication, the epidural narcotic dose was decreased until the side effect subsided, or another narcotic was started.

ON-Q Local Anesthetic Infiltrating Catheter Group

For patients who received an ON-Q local anesthetic infiltrating catheter, the catheter was placed intraoperatively by the surgical team at the end of the procedure. The ON-Q catheter consisted of a multi-orifice tube that was inserted along the inferior border of the rib along the incision so that the tip lay in a space created underneath the longissimus dorsi muscle, placing the catheter close to the costovertebral joints. The catheter was bolused with 5 mL of ropivacaine 0.5% before skin closure. After skin closure, the ON-Q pump, containing 0.5% ropivacaine, was connected and set to deliver 2 mL/hour, and the wound also was infiltrated with ropivacaine 0.5%. Patients also were given an IV PCA device, commonly hydromorphone 0.2 mg every 10 minutes without a basal dose, which was started immediately in the post-anesthetic care unit. The ON-Q catheter was maintained until postoperative day 3, at which time it was removed by either the surgical team in the outpatient setting or by the patient.

Pain Assessment

Patients' pain was assessed by a nurse assigned to their care using the Numeric Rating Scale, by which patients were asked to rate their pain on a scale from 0 (no pain) to 10 (disabling pain).

Statistical Analysis

The following baseline demographic and clinical characteristics were collected from patient records: age, sex, ASA score, readmission, pain ratings, length of hospital stay, and total bill generated.

Pain scores for each group were summarized in terms of minimum, maximum, median, and mean. The associations between treatment and patient sex, ASA score, and readmission rate were assessed by the chi-square test. For the primary endpoint, the Wilcoxon rank sum test was used to compare the distributions in the average and maximum pain scores and in hospital stay and cost between the epidural and ON-Q groups.

RESULTS

A total of 50 patients' records were included in this study. The median age of patients was 62 years (range 24-81 years). Of the patients included in the study, 70.0% were men and 30.0% were women; 8.2% had an ASA score of 2 and 91.8% had an ASA score of 3 (Table 1). The 2-week readmission rate was 4.0%. The median length of hospital stay was 3 days (range 1–5 days) (Table 2).

The median average pain score on day 1 was 1.8 (range 0-7); the median average pain score on day 2 was 1.5 (range 0-5.7); the median pain score on day 3 was 0.8 (range 0-5.7); and the median pain score at the time of discharge was 1.4 (range 0-5.7) (Table 3). Of the 50 patients, 48.0% (24) received epidural analgesia, and 52.0% (26) received an ON-Q catheter.

There was no significant difference between the 2 treatment groups in terms of age, sex, ASA score, or readmission rate (all p values > 0.05). (Table 1)

Table 1. Patient Characteristics by Treatment (Epidural *v* On-Q)

Covariate	Levels	Treatment Epidural (n = 24)	Treatment On-Q (n = 26)	*P* value (Fisher's exact test)
Sex	F	8 (33.3%)	7 (26.9%)	0.7598
	M	16 (66.7%)	19 (73.1%)	.
ASA score	2	1 (4.2%)	3 (12%)	0.6092
	3	23 (95.8%)	22 (88%)	.
Readmission	No	23 (95.8%)	25 (96.2%)	1.000
	Yes	1 (4.2%)	1 (3.8%)	.

Abbreviations: F, female; M, male; ASA, American Society of Anesthesiologists.

Regarding average pain scores over time by treatment, the patients in the epidural group had lower average pain scores on day 2 than did the patients in the ON-Q group ($p = 0.016$) (Table 3). The treatment effect was significant in the repeated measures regression model ($p = 0.035$). Average pain ratings at the time of postoperative surgical follow-up showed no difference between groups (Table 3).

Regarding maximum pain scores over time by treatment, on day 1 and day 2 and at the time of discharge, patients in the epidural group had significantly lower maximum pain scores than did patients in the ON-Q group (Table 4). On day 3, there was no significant difference in maximum pain scores between the 2 treatment groups (Table 4). The treatment effect was significant in the repeated measures regression model ($p = 0.007$). There was no significant difference between the 2 study groups in pain scores at the postoperative follow-up visit ($p > 0.05$) (Table 2).

The distributions of length of hospital stay differed significantly between the 2 treatment groups (overall, $p = 0.003$). The patients who received the ON-Q catheter had a shorter hospital stay than did patients in the epidural group (Table 2). The hospital bill distributions differed significantly between the 2 treatment groups (overall, $p = 0.032$). Patients in the ON-Q group had lower hospital bills than did patients in the epidural group (Table 2).

No complications were reported from epidurals or from the ON-Q catheters. There was 1 readmission in each group; 1 patient in the epidural group had lung herniation and 1 patient in the ON-Q group had lung effusion.

Two of the patients in the ON-Q group were sent home with the catheter still in place; these were removed on postoperative day 3 by the patients themselves.

Two patients in the ON-Q group rated their pain >6 on the NRS at follow-up, and three in the epidural group did so 1 week later; only one of them had a previous history of chronic pain. These patients were considered outliers as they needed stronger opioids, oxycodone. Most patients in both groups were discharged home taking hydrocodone, 10 mg, + acetaminophen, 325 mg.

DISCUSSION

The retrospective analysis revealed that even though the maximum pain score was higher in the ON-Q group, patients in that group were comfortable enough to be discharged earlier,